# Size, Age, Meristics, and Morphometrics of Chum Salmon Returning to Southern British Columbia During 1981-1982

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# SIZE, AGE, MERISTICS, AND MORPHOMETRICS OF CHUM SALMON RETURNING TO SOUTHERN BRITISH COLUMBIA DURING 1981 - 1982.

by

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## ABSTRACT

Beacham, T. D., A. P. Gould, and A. P. Stefanson. 1983. Size, age, meristics, and morphometrics of chum salmon returning to southern British Columbia during 1981-1982. Can. Tech. Rep. Fish. Aquat. Sci. No. 1207: iv + 37 p.

Differences in sex ratios-at-age, mean length-at-age, age compositions, meristics, and morphometrics were investigated for early and late spawning chum salmon stocks in Johnstone Strait, Strait of Georgia, and the Fraser River. Males were more abundant than females at ages 3 and 5, but less abundant at age 4. Mean length-at-age was similar between early and late spawning stocks. However, early spawning stocks in the Fraser River and on Vancouver Island had older age composition than did later spawning stocks. This seasonal change in age composition was illustrated by the Johnstone Strait and the Fraser River test fisheries. Early returning stocks had fewer gill rakers than did late returning stocks. Males had larger heads, larger dorsal fins, and thicker caudal peduncles than did females. Morphometric characters also varied among stocks surveyed.

Key words: age, British Columbia, chum salmon, length, meristics, morphometrics sex ration, size

## RÉSUMÉ

Beacham, T. D., A. P. Gould, and A. P. Stefanson. 1983. Size, age, meristics, and morphometrics of chum salmon returning to southern British Columbia during 1981-1982. Can. Tech. Rep. Fish. Aquat. Sci. No. 1207: iv + 37 p.

On a étudié les différences dans les rapports des sexes par âge, la longueur moyenne par âge, la composition par âge, les caractères méristiques et morphométriques pour des stocks reproducteurs de saumon kéta précoces et tardifs dans le détroit de Johnstone, le détroit de Géorgie et le fleuve Fraser. Les mâles étaient plus nombreux que les femelles aux âges 3 et 5, mais étaient moins nombreux à l'âge 4. La longueur moyenne par âge était semblable entre les stocks de reproducteurs précoces et tardifs. Cependant, les stocks de reproducteurs précoces dans le fleuve Fraser et sur l'île Vancouver avaient une composition par âge plus vieille que les stocks de saumon qui frayent plus tard. Ce changement saisonnier dans la composition par âge a été mis en lumière par les pêches d'essai dans le détroit de Johnstone et le fleuve Fraser. Les stocks retournant tôt aux frayères avaient un moins grand nombre de branchiospines que les stocks y retournant tard. Les mâles avaient une tête plus grosse, des nageoires dorsales plus larges et des pédoncules caudals plus épais que les femelles. Les caractères morphométriques différaient également entre les stocks étudiés.

Mots-clés: âge, Colombie-Britannique, saumon kéta, longueur, caractères méristiques, caractères morphométriques, rapport des sexes, taille.

## INTRODUCTION

Chum salmon (Oncorhynchus keta) returning to spawn in their natal streams on the east coast of Vancouver Island, the mainland coast of the Strait of Georgia, the mainland inlets (Jervis, Toba, Bute, Loughborough, and Knight) and the Fraser River primarily migrate through Johnstone Strait during August through December (Anderson and Beacham 1983). The main period of migration through Johnstone Strait is late September through early November (Anderson and Beacham 1983). Depending on abundance, there are extensive net fisheries in Johnstone Strait for chum salmon and terminal net fisheries in the Strait of Georgia. Chum salmon may also be harvested in gill net fisheries in the Fraser River.

Stock compositon is a major concern in the management of these fisheries, so in the autumn of 1981 and 1982 a sampling program was undertaken in order to investigate methods of stock identification for chum salmon. As part of the sampling procedure, sex and length of chum salmon were recorded, and scales taken for age determination. Meristic counts and morphometric measurements of specific characters were also recorded for each fish. Age and size compositions of chum salmon in fisheries and spawning escapements are of considerable value in an assessment of stock status. These characteristics were recorded as part of the biological characteristics investigated for the many stocks considered in the sampling program.

Differences in biological characteristics of early and late spawning stocks can be of considerable biological interest, as well as an aid in assessing stock status and possible fishery management actions. Smirnov (1975) has reported that there can be considerable differences in biological characteristics of early and late spawning chum salmon. Potential differences in these characteristics were investigated in this report. This report summarizes the age, size, meristic, and morphometric characteristics of chum salmon returning to natal streams and caught in test fisheries in the southern coastal region of British Columbia.

## MATERIALS AND METHODS

Chum salmon were sampled from 10 areas in the Fraser River drainage, 9 areas from the east coast of Vancouver Island, and 9 areas from the mainland coast of the Strait of Georgia and the mainland inlets (Fig. 1). They were also sampled from 7 test fisheries, 1 in Johnstone Strait, 1 in the Fraser River, and 5 in Georgia Strait (Fig. 2). Chum salmon sampled on the spawning grounds were collected during October through December of 1981 and 1982 (Table 1). Chum salmon on the spawning grounds were caught primarily with beach seines, although 6-1/4 in (159 mm) mesh gillnets were used extensively to collect chum salmon from the mainland inlets and mainland Georgia Strait locations. Pews for live fish and dead pitching were also occasionaly used to collect chum salmon. Chum salmon in the test fisheries were collected

primarily with gillnets, being 6-1/4 in (159 mm) mesh in the Strait of Georgia test fisheries and 6-3/4 in (171 mm) mesh in the Fraser River test fishery. Chum salmon in the Johnstone Strait test fishery were caught with a purse seine.

The biological characteristics recorded included sex, postorbital-hypural length to the nearest mm, number of gill rakers on left most anterior gill arch, number of branchiostegal rays on left side, postorbital head length (mm) (Vladykov 1962), caudal peduncle depth (mm), and length of the base (mm) and height (mm) of both the dorsal and anal fins (Hubbs and Lagler 1958). All meristic and morphometric observations were recorded in the field. Morphometric characters were measured with calipers to the nearest mm. Scales were also collected for age determination. Bilton and Ricker (1965) and LaLanne and Safsten (1969) have outlined the methodology of using scales for aging chum salmon. The data were generally recorded in such a manner as to be able to relate a particular fish's sex, length, meristic characters, and morphometric characters to its age. However, this was not possible for the Johnstone Strait test fishery, and only weekly age compositions are available from that fishery.

Differences in sex ratios, mean length-at-age, age compositions, meristics, and morphometrics were investigated for early and late spawning stocks. Stocks were defined as early or late spawning based upon their relative passage of timing through upper Johnstone Strait. In most instances, the relative timing of the stocks surveyed have been outlined by Anderson and Beacham (1983). In general, early timing stocks for this study were sampled before November 20th, and later timing stocks subsequent to that date. When the timing of a stock surveyed in the present study was not outlined by Anderson and Beacham (1983), then its classification as either early or late was dependent upon the general timing of stocks in the same area, the date of sampling, and general timing of escapements available from stream surveys.

The analysis of sex ratios by age required an adjustment to the original data. This adjustment was required because the sex ratios by age would be biased if equal numbers of males and females were not sampled in each area. The number of females sampled in each age group was multiplied by the ratio of males:females in the sample, thereby equalizing the sample sex ratio. If age of return is completely random with respect to sex, then one would expect 50:50 sex ratios of each age for the adjusted samples.

Preliminary analysis indicated that there were significantly different allometric regressions (log morphometric character = log a + b log length) between sexes and among stocks within each sex. Morphometric measurements of both males and females were standardized to the overall mean length of the spawning ground samples (58.7 cm), thereby minimizing variability as a result of allometric growth and differences in mean size of individuals among stocks (Gould 1966, Thorpe 1976). Measurements were adjusted in the manner outlined by Ihssen et al. (1981). There were separate sex, location, and stock regressions to standardize measurements from spawning ground samples.

# RESULTS

## SEX RATIOS

The analysis of sex ratios by age indicated some consistent trends. At age 3, males were more common than females (Table 2). With the samples from all spawning grounds and the test fisheries pooled, 58.5% of the returns at age 3 were males ($\chi^2$ = 41.4, P<0.01). At age 4, 46.6% were males ($\chi^2$ = 19.1, P<0.01). At age 5, 54.5% were males ($\chi^2$ = 2.5, P>0.05). There was a tendency for males to be more numerous than females at ages 3 and 5, and for females to outnumber males at age 4 (Fig. 3). Sample sizes were lower for age 5 chum salmon compared with the other ages, and the difference between male and female proportions was not statistically significant. The same trends in sex ratios for each age were found for early and late returning stocks for the three major spawning areas surveyed (Table 2). The low proportion (41%) of males at age 5 in samples collected for late mainland spawning stocks is likely due to the small number (17) of 5-year old chum salmon sampled and thus the observed sex ratio was probably subject to sampling error.

## MEAN LENGTH

Mean length-at-age for chum salmon sampled during the program are outlined in Table 3. Differences in size between the sexes were investigated by sign test analysis. When males were larger than females, the test was scored '+'; when they were smaller, it was scored '-'. Males were significantly larger than females at age 3 (25+, 11-, P<0.05), age 4 (35+, 5-, P<0.01), but not significantly so at age 5 (16+, 8-, P>0.05). Males were larger than females at all ages examined.

Chum salmon of age 2 were also sampled during 1982. All were males, and mean lengths were as follows:

| Location | N | Length (cm) |
|---|---|---|
| Chemainus R. | 2 | 48.0 |
| Goldstream R. | 1 | 44.1 |
| Puntledge test | 1 | 43.8 |

All age 2 males sampled on the spawning grounds were collected in two rivers on southern Vancouver Island, and the male sampled in the test fishery probably also originated from Vancouver Island.

There were no consistent differences in mean length-at-age for early and late spawning stocks in the three main areas surveyed. Age 3 males were about 56 cm postorbital-hypural length, age 4 59 cm, and age 5 62 cm. Age 3 females were 54 cm, age 4 were 57 cm, and age 5 were 61 cm. Size at return within each age did not depend upon the relative timing of the spawning migration of the stock.

## AGE OF RETURN

Chum salmon were collected with beach seines, gillnets, pews, and by dead pitch (Table 1). However, some of the gear is selective for size, with gillnets generally selecting larger fish and pews smaller, more accessible individuals. Samples collected by these two methods were thus discarded for the subsequent analysis of age at return.

Age of return of chum salmon in the Fraser River stocks and Vancouver Island stocks was dependent upon the relative timing of the spawning migrations of the stocks. For the Fraser River early returning stocks, 12% of the returns were age 3, 73% were age 4, and 15% were age 5 (Table 4). Similar figures for late returning Fraser River stocks were 39%, 58% and 3%, respectively. Early run Fraser River stocks returned in significantly lower proportions at age 3 than did late run stocks ($\chi^2$ = 90.0, P<0.01), and higher proportions of age 4 ($\chi^2$ = 11.5, P<0.01) and age 5 ($\chi^2$ = 46.2, P<0.01). Mean age of return for the early run stocks was 4.03 yr, whereas that for the late run stocks was 3.64 yr.

Chum salmon stocks sampled on Vancouver Island showed a similar trend in age composition relative to timing as did those in the Fraser River. Early returning stocks were comprised of 15% age 3, 79% age 4, and 6% age 5. Similar values for late Vancouver Island stocks were 31%, 66%, and 3%, respectively (Table 4). Early run Vancouver Island stocks returned in lower portions at age 3 than did late run stocks ($\chi^2$ = 47.0 P<0.01), and higher proportions at age 4 ($\chi^2$ = 9.7, P<0.01) and age 5 ($\chi^2$ = 7.8 P<0.01). Mean age of return for the early run stocks was 3.92 yr whereas that for the late run stocks was 3.73 yr.

Sample sizes of chum salmon collected from mainland stocks are limited (Table 4). There was no differences in age at return between early and late mainland stocks north of the Fraser. In particular, the proportion of age 3 in the late returning stocks was 14%, on par with early returning stocks in the other areas investigated. However, this result is heavily influenced by the 1981 Cheakamus River sample in which no age 3 chum salmon were present. If that sample is excluded, then 24% of the late mainland returns were age 3. It may be then that there is a tendency for late mainland stocks to contain higher proportions of age 3 chum salmon than early mainland stocks, but more sampling with nonselective gear is necessary to investigate this aspect.

## TIMING

Age compositions of chum salmon were available from test fisheries in 7 separate locations in southern British Columbia (Table 5). Extensive weekly samples were only available from two, namely the Johnstone Strait and Fraser River test fisheries. The gear used for collection in the former one was a purse seine, whereas a gillnet was used in the latter.

The analysis of chum salmon collected on the spawning grounds indicated that early timing stocks tended to have higher proportions of older fish than did late timing stocks. This trend was confirmed by the Johnstone Strait test fishery in which the proportion of age 4 and 5 in the migrating chum salmon declined during September through October, while the proportion of age 3 increased (Fig. 4). This same trend was also evident in Fraser River chum salmon stocks (Fig. 5), as was indicated by the spawning ground sampling.

In the Johnstone Strait test fishery, the proportion of age 3 in the stocks increased from 11% to 31% during a 9-week period commencing September 4, 1982. In the Fraser River test fishery, the proportion of age 3 in the stocks increased from 12% to 45% during a 10-week period commencing October 6, 1982. Trends to increasing proportions of age 3 in the stocks was also evident in the 1981 Big Qualicum test fishery and 1982 Puntledge test fishery.

## MERISTICS

Numbers of gill rakers on individual chum salmon ranged from 17 to 26 (Table 6). As chum salmon were aged in the study, it was possible to examine trends in mean number of gill rakers for the 1976-1979 brood years (Table 7). There was no difference in mean gill raker counts between males and females ($F = 0.73$; $df = 1, 3725$; $P>0.10$), but significant differences among brood years ($F = 6.61$; $df 3, 3746$; $P<0.01$). Early returning stocks had, on average, fewer gill rakers than later returning stocks (Fraser River $G = 56.4$, $P<0.01$; Vancouver Island $G = 46.5$, $P<0.01$; Mainland $G = 41.8$, $P<0.01$). Chum salmon from the Fraser tended to have more gill rakers than those from Vancouver Island or the Mainland for both early and late returning stocks (Table 7).

Although there was no difference between males and females for mean number of gill rakers, there were significant differences between the sexes for mean number of branchiostegal rays ($F = 7.4$; $df = 1, 3725$, $P<0.01$). Females had, on average, more branchiostegal rays than did males (Table 8). However, there was no significant variability in mean number of branchiostegal rays for the 1976-1979 brood years ($F = 1.1$; $df = 3, 3745$; $P>0.10$). There was also no difference between early and late returning stocks in mean number of branchiostegal rays. Chum salmon from Vancouver Island had, on average, fewer branchiostegal rays (13.0) than did chum salmon from the Fraser River (13.3) or the Mainland locations (13.3).

## MORPHOMETRICS

All morphometric measurements considered in this report were standardized to 58.7 postorbital-hypural length by individual sex and stock regressions. Three way analysis of variance (indices were location, sex, and brood year) indicated that there were significant differences in postorbital head length among locations ($F = 24.6$; $df = 26, 3745$; $P<0.01$) between sexes

(with males larger) ($F = 2188.8$, $P<0.01$), and among brood years ($F = 12.7$, $P<0.01$). The same result was found in the analysis of variability in caudal peduncle depth (all $P<0.01$) and length of the base of the anal fin (all $P<0.01$). There were significant differences in height of the anal fin among stocks sampled ($F = 25.9$, $P<0.01$) but not among brood years ($F = 2.4$, $P>0.05$). The length of the base of the dorsal fin and dorsal fin height were different among stocks, between sexes with males having larger dorsal fin measurements in both instances, and among brood years (all $P<0.01$).

Chum salmon from the Fraser River had larger heads (males 9.5 cm, females 8.7 cm) than did chum salmon from Vancouver Island (males 9.3 cm, females 8.6 cm) or the Mainland (males 9.3 cm, females 8.6 cm) (Tables 9, 10). Similar results were also found in the analysis of variability of caudal peduncle depth, length of base and height of the anal fin. Fraser River chum salmon did not, however, have consistently larger dorsal fin bases or heights than chum salmon from the other areas surveyed.

## DISCUSSION

In the present study, sex ratios were not equal at each age of return. Males were found to be more abundant than females at ages 3 and 5, and females more abundant than males at age 4. Similar results were found by Beacham and Starr (1982) in an analysis of the Fraser River test fishery during 1960-79. The higher proportions of males at the younger ages of return has been outlined for other Oncorhynchus species (Foerster 1968, Bilton et al. 1982). The tendency for higher proportions of males at age 5 may be a consequence of selection for large size in breeding males. There seems to be two strategies for males. One is to be a fast-growing, early maturing, and smaller male and perhaps act as "satellite" male (Schroder 1981) in the breeding population. The other is for slower growth, later maturity, and larger size at spawning, thereby presumably acting as a "dominant" male.

Age of return of chum salmon in British Columbia was previously investigated by Pritchard (1943). Of all the areas surveyed, age 2 chum were recorded only from late returning stocks fom south-eastern Vancouver Island and at Qualicum, similar to the results of the present study and those of Glova and McCart (1979). Mean age of return of a brood year have been reported to increase with brood year abundance (Birman 1951, Helle 1979, Beacham and Starr 1982). The present study indicates that in southern coastal British Columbia, mean age of return may also be dependent upon relative stock timing. Glova and McCart (1979), in a survey of chum salmon stocks returning to Tlupana Inlet on the west coast of Vancouver Island, also found that early returning stocks had older age compositions than a later returning one. Although changes in age composition during the spawning period have only been illustrated for the 1982 Johnstone Strait test fishery, similar trends have been noted in previous years (unpublished data). These repeatable annual trends suggest that differences in age composition between early and late run stocks are not a result of differences in brood year abundance within each group.

The lower mean age of return in late-spawning stocks as compared with early ones may indicate that, on average, population growth rates are faster in the late spawning stocks surveyed. Returning three year olds are larger than three year olds remaining at sea for at least another year (Ricker 1964), and if late spawning stocks have higher proportions of age 3 chum salmon than early spawning ones, then the average stock growth rate may be faster. Alternatively, age 3 chum salmon in late returning stocks may grow at the same rate as in early returning stocks, but have more time to attain a "threshold" size necessary to become sexually mature.

The differences in age composition between early and late spawning stocks may suggest that there could be a genetic component to age of return in chum salmon. Timing of return has been indicated to have a genetic component in pink salmon (Oncorhynchus gorbuscha) (Bams 1976, Taylor 1980). A genetic component to age of return in other Oncorhynchus species has been outlined by Ricker (1972) and Donaldson and Menasveta (1961). An experiment designed to investigate genetic influence on age at maturity in chum salmon should be undertaken in order to evaluate differences among stocks in mean age at maturity.

Meristic variation in chum salmon has been investigated by Rounsefell (1962) and Bakkala (1970). Ranges for gill raker count were within those outlined by Rounsefell, except for two individuals with a frequency of 17 gill rakers. Branchiostegal rays counts were also similar to the ranges outlined by Bakkala (1970) (13.4-14.5). The present study indicated that there was a significant difference in gill raker frequencies between early and late returning stocks. This difference may be due in part to different environmental conditions experienced during incubation. Lindsey (1981) indicated that there can be significant environmental influences on gill raker frequencies in whitefish (Coregonus). However, Ihssen et al. (1981) found that patterns in meristic variability in whitefish more closely resembled the pattern of genetic variability (described through electrophoresis) than did morphometric variability.

Stock differences in morphometric characters in chum salmon were investigated by Svetovidova (1961), who found that males generally had larger heads, caudal peduncle depths, and dorsal fins than did females. However, there was little difference in the length of the anal fin between the sexes. Similar patterns for the variability in morphometric characters were found in the present study. Chum salmon from the Fraser River had, on average, longer heads, larger fins, and thicker caudal peduncles than did chum salmon from smaller rivers. Riddell and Leggett (1981) found similar results for juvenile Atlantic salmon (Salmo salar) where individuals from a faster flowing river had larger body parts than did individuals from a slower flowing river. Further work to investigate the relationship between morphometric and environmental variability would be desirable.

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Table 1. Areas sampled, time of sampling and gear used to collect samples of chum salmon in southern British Columbia.

| Area | Date | Gear |
|---|---|---|
| Fraser River | | |
| Weaver Creek | 2 November 1982 | pew |
| Harrison Creek | 2, 6 December 1981 | seine |
| Squakum Creek | 9 December 1981 | pew |
| Inch Creek | 8 December 1981 | seine |
| Vedder River | 3, 4 November 1981 | seine |
| Vedder River | 2 November 1982 | seine |
| Stave River | 9 November 1982 | seine |
| Blaney Creek | 28 October 1982 | seine |
| Harrison River | 24 November 1982 | seine |
| Chehalis River | 24, 25 November 1982 | seine |
| Squakum Creek | 10 November 1982 | seine |
| Waleach Slough | 25 November 1982 | seine |
| Mainstem | 8, 14 December 1982 | gillnet |
| Vancouver Island | | |
| Nanaimo River | 22 October 1981 | seine |
| Chemainus River | 23 December 1981 | seine |
| Big Qualicum River | 30 November 1981 | dead pitch |
| Little Qualicum River | 17 November 1981 | dead pitch |
| Puntledge River | 19 November 1981 | seine |
| Goldstream River | 29 November 1982 | seine |
| Cowichan River | 7, 8, 9 December 1982 | seine |
| Chemainus River | 7 December 1982 | seine |
| Nanaimo River | 26 October 1982 | seine |
| Little Qualicum River | 18 November 1982 | dead pitch |
| Rosewall Creek | 6 December 1982 | seine |
| Puntledge River | 17 November 1982 | seine |
| Nimpkish River | 13 December 1982 | seine |
| Mainland | | |
| Sliammon River | 10 November 1981 | seine |
| Cheakamus River | 3 December 1981 | seine |
| Southgate River | 7 October 1982 | gillnet |
| Toba River | 10 November 1982 | gillnet |
| Okeover Creek | 3 November 1982 | pew |
| Saltery Bay Creek | 2 November 1982 | gillnet |
| Tzoonie River | 17 November 1982 | gillnet |
| Mamquam River | 1 December 1982 | seine |
| Indian River | 28 November 1982 | seine |
| Test Fisheries | | |
| Big Qualicum | 21 Oct - 13 Nov 1981 | gillnet |
| Big Qualicum | 12 November 1982 | gillnet |
| Upper Johnstone Strait | 4 Sept - 28 Oct 1982 | seine |
| Puntledge | 13 Oct - 1 Nov 1982 | gillnet |
| Texada Island | 1, 12 November 1982 | gillnet |
| Nanaimo | 12 November 1982 | gillnet |
| Cowichan | 29 Oct - 10 Nov 1982 | gillnet |
| Fraser River | 6 Oct - 9 Dec 1982 | gillnet |

Table 2. Sex ratios (% males) of chum salmon of ages 3, 4, and 5 years sampled in southern British Columbia during 1981-82. Adjusted percentages of males for each age were determined by multiplying the observed number of females in each age class by the ratio of males:females in the sample in order to equalize the number of males and females sampled.

| | | Age | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 3 | | | 4 | | | 5 | | | No. sampled | |
| Area | Year | N | Obs | Adj | N | Obs | Adj | N | Obs | Adj | Male | Female |
| **Fraser River Early Returning Stocks 1981-82** | | | | | | | | | | | | |
| Weaver Cr | 1982 | 32 | 71.9 | 57.9 | 63 | 58.7 | 35.4 | 5 | 100.0 | 100.0 | 65 | 35 |
| Squakum Cr | 1981 | 6 | 0.0 | 0.0 | 18 | 55.6 | 65.4 | 1 | 0.0 | 0.0 | 10 | 15 |
| Vedder R | 1981 | 5 | 60.0 | 56.6 | 181 | 51.9 | 48.9 | 14 | 64.3 | 61.6 | 105 | 94 |
| Vedder R | 1982 | 5 | 40.0 | 52.6 | 70 | 32.9 | 44.4 | 25 | 52.0 | 63.7 | 38 | 62 |
| Blaney R | 1982 | 25 | 80.0 | 80.6 | 30 | 43.3 | 44.4 | 45 | 35.6 | 36.5 | 49 | 51 |
| Stave R | 1982 | 16 | 37.5 | 63.2 | 81 | 23.5 | 46.6 | 3 | 33.3 | 58.8 | 26 | 74 |
| Squakum Cr | 1982 | 19 | 63.2 | 49.2 | 78 | 62.8 | 48.7 | 3 | 100.0 | 100.0 | 64 | 36 |
| Total | | 108 | 61.1 | 58.9 | 521 | 46.7 | 47.0 | 96 | 49.4 | 52.8 | 358 | 357 |
| **Fraser River Late Returning Stocks 1981-82** | | | | | | | | | | | | |
| Inch Cr | 1981 | 64 | 40.6 | 51.7 | 31 | 38.7 | 49.8 | 5 | 20.0 | 27.8 | 39 | 61 |
| Harrision R | 1981 | 49 | 20.4 | 31.3 | 140 | 40.0 | 54.3 | 11 | 54.5 | 68.2 | 72 | 128 |
| Harrision R | 1982 | 66 | 77.3 | 60.4 | 34 | 52.9 | 33.5 | 0 | - | - | 69 | 31 |
| Chehalis R | 1982 | 39 | 92.3 | 85.1 | 58 | 50.0 | 32.0 | 3 | 100.0 | 100.0 | 68 | 32 |
| Waleach | 1982 | 18 | 38.9 | 46.7 | 82 | 42.7 | 50.7 | 0 | - | - | 42 | 58 |
| Mainstem | 1982 | 40 | 35.0 | 52.6 | 54 | 31.5 | 48.7 | 1 | 0.0 | 0.0 | 31 | 64 |
| Total | | 276 | 52.2 | 57.3 | 399 | 41.9 | 44.4 | 20 | 47.6 | 58.8 | 321 | 374 |
| **Vancouver Island Early Returning Stocks 1981-82** | | | | | | | | | | | | |
| Nanaimo R | 1981 | 0 | - | - | 94 | 17.0 | 50.0 | 6 | 16.7 | 50.0 | 17 | 83 |
| Nanaimo R | 1982 | 6 | 0.0 | 0.0 | 85 | 0.0 | 0.0 | 8 | 0.0 | 0.0 | 0 | 99 |
| Puntledge R | 1981 | 30 | 43.3 | 49.2 | 156 | 43.6 | 49.6 | 14 | 50.0 | 56.0 | 88 | 112 |
| Puntledge R | 1982 | 18 | 11.1 | 43.5 | 78 | 12.8 | 47.4 | 4 | 50.0 | 87.0 | 14 | 86 |
| L. Qualicum R | 1981 | 50 | 64.0 | 59.9 | 143 | 51.0 | 48.6 | 6 | 50.0 | 45.5 | 108 | 91 |
| L. Qualicum R | 1982 | 13 | 61.5 | 60.6 | 75 | 46.7 | 45.7 | 12 | 66.7 | 65.6 | 51 | 49 |
| Total | | 117 | 47.0 | 65.1 | 631 | 32.0 | 47.8 | 50 | 42.0 | 58.3 | 278 | 520 |
| **Vancouver Island Late Returning Stocks** | | | | | | | | | | | | |
| B. Qualicum R | 1981 | 52 | 69.2 | 55.9 | 138 | 61.6 | 47.4 | 10 | 70.0 | 56.9 | 128 | 72 |
| Chemainus R | 1981 | 18 | 50.0 | 54.9 | 33 | 45.6 | 50.2 | 2 | 0.0 | 0.0 | 24 | 29 |
| Chemainus R | 1982 | 55 | 81.8 | 64.3 | 41 | 56.1 | 33.8 | 2 | 100.0 | 100.0 | 70 | 28 |
| Goldstream R | 1982 | 13 | 61.5 | 52.3 | 70 | 60.0 | 50.7 | 8 | 50.0 | 40.8 | 54 | 37 |
| Cowichan R | 1982 | 56 | 64.3 | 55.6 | 140 | 55.7 | 46.7 | 4 | 100.0 | 100.0 | 118 | 82 |
| Rosewall Cr | 1982 | 43 | 67.4 | 56.0 | 49 | 57.1 | 45.0 | 0 | - | - | 57 | 35 |
| Nimpkish R | 1982 | 18 | 50.0 | 43.7 | 69 | 58.0 | 51.7 | 0 | - | - | 49 | 38 |
| Total | | 255 | 67.5 | 57.8 | 540 | 57.6 | 46.6 | 26 | 65.4 | 57.0 | 500 | 321 |

Table 2 (cont'd)

| Area | Year | Age 3 N | 3 Obs | 3 Adj | Age 4 N | 4 Obs | 4 Adj | Age 5 N | 5 Obs | 5 Adj | No. sampled Male | No. sampled Female |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mainland Early Returning Stocks** | | | | | | | | | | | | |
| Sliammon R | 1981 | 16 | 62.5 | 52.6 | 77 | 59.7 | 50.3 | 7 | 57.1 | 47.1 | 60 | 40 |
| Southgate R | 1982 | 16 | 75.0 | 59.4 | 85 | 64.7 | 47.1 | 3 | 100.0 | 100.0 | 70 | 34 |
| Okeover R | 1982 | 65 | 43.1 | 48.4 | 34 | 44.1 | 49.5 | 4 | 75.0 | 78.9 | 46 | 57 |
| Toba R | 1982 | 1 | 100.0 | 100.0 | 3 | 0.0 | 0.0 | 1 | 100.0 | 100.0 | 2 | 3 |
| Total | | 98 | 52.0 | 52.0 | 199 | 58.3 | 48.1 | 15 | 73.3 | 68.8 | 178 | 134 |
| **Mainland Late Returning Stocks** | | | | | | | | | | | | |
| Chemainus R | 1981 | 0 | - | - | 99 | 73.7 | 49.7 | 1 | 100.0 | 100.0 | 74 | 26 |
| Saltery Bay Cr | 1982 | 18 | 66.7 | 58.5 | 52 | 55.8 | 47.2 | 0 | - | - | 41 | 29 |
| Tzoonie R | 1982 | 11 | 72.7 | 67.8 | 92 | 56.5 | 50.5 | 4 | 0.0 | 0.0 | 60 | 47 |
| Manquam R | 1982 | 27 | 74.1 | 53.5 | 64 | 70.3 | 48.8 | 10 | 70.0 | 48.6 | 72 | 29 |
| Indian R | 1982 | 9 | 11.1 | 20.8 | 39 | 35.9 | 54.3 | 2 | 50.0 | 66.7 | 16 | 34 |
| Total | | 65 | 63.1 | 54.7 | 346 | 61.6 | 49.5 | 17 | 52.9 | 40.9 | 263 | 165 |
| **Test Fisheries** | | | | | | | | | | | | |
| Big Qualicum | 1981 | 98 | 60.2 | 60.0 | 463 | 48.2 | 47.9 | 10 | 60.0 | 60.0 | 288 | 283 |
| Big Qualicum | 1982 | 8 | 75.0 | 66.7 | 14 | 50.0 | 40.0 | 3 | 66.7 | 57.1 | 15 | 10 |
| Nanaimo | 1982 | 24 | 54.2 | 59.6 | 70 | 40.0 | 45.6 | 3 | 66.7 | 71.4 | 43 | 54 |
| Cowichan | 1982 | 62 | 71.0 | 69.0 | 125 | 43.2 | 40.9 | 4 | 50.0 | 47.6 | 100 | 91 |
| Puntledge | 1982 | 57 | 47.4 | 44.9 | 183 | 54.1 | 51.6 | 15 | 53.3 | 50.6 | 134 | 121 |
| Fraser R | 1982 | 171 | 73.7 | 67.3 | 313 | 48.6 | 41.0 | 16 | 62.5 | 54.9 | 288 | 212 |
| Texada Is | 1982 | 55 | 56.4 | 63.0 | 59 | 30.5 | 36.7 | 2 | 50.0 | 55.6 | 50 | 66 |
| Total | | 475 | 64.4 | 62.4 | 1227 | 47.4 | 45.1 | 53 | 58.5 | 55.4 | 918 | 837 |
| **All Locations** | | | | | | | | | | | | |
| All samples | | 1394 | 59.9 | 58.5 | 3863 | 47.5 | 46.6 | 277 | 52.7 | 54.5 | 2816 | 2718 |

Table 3. Mean postorbital-hypural length (cm)-at-age for chum salmon sampled on the spawning grounds and in test fisheries in southern British Columbia during 1981 and 1982. Standard deviations are in parenthesis. Sample size is below each length.

| | | Age | | | | | |
|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | |
| Area | Year | Male | Female | Male | Female | Male | Female |
| **Fraser River Early Returning Stocks** | | | | | | | |
| Weaver Cr | 1981 | 53.1(.7) | 53.2(.9) | 56.1(.6) | 56.2(.6) | 62.1(1.0) | - |
| | | 23 | 9 | 37 | 26 | 5 | 0 |
| Squakum Cr | 1981 | - | 52.4(1.4) | 60.5(1.2) | 56.8(.9) | - | 58.0(.0) |
| | | (.0) | 6 | 10 | 8 | 0 | 1 |
| Vedder R | 1981 | 55.8(.4) | 54.8(2.3) | 59.7(.3) | 57.5(.3) | 61.1(1.5) | 60.0(.6) |
| | | 3 | 2 | 94 | 87 | 9 | 5 |
| Vedder R | 1982 | 57.3(.9) | 51.4(1.4) | 59.6(.5) | 58.5(.4) | 61.7(.8) | 60.7(.8) |
| | | 2 | 3 | 23 | 47 | 13 | 12 |
| Blaney Cr | 1982 | 55.5(.6) | 54.5(.8) | 58.3(.8) | 56.7(.7) | 61.6(.8) | 60.8(.6) |
| | | 20 | 5 | 13 | 17 | 16 | 29 |
| Stave R | 1982 | 57.4(1.1) | 54.8(.6) | 59.2(.6) | 57.5(.3) | 62.2(.0) | 64.9(.8) |
| | | 6 | 10 | 19 | 62 | 1 | 2 |
| Squakum Cr | 1982 | 54.4(.8) | 54.8(.8) | 57.3(.5) | 58.2(.5) | 59.9(.7) | - |
| | | 12 | 7 | 49 | 29 | 3 | 0 |
| **Fraser River Late Returning Stocks** | | | | | | | |
| Inch Cr | 1981 | 54.9(.6) | 53.6(.4) | 58.2(.6) | 57.9(.8) | 63.1(.0) | 60.9(1.3) |
| | | 26 | 38 | 12 | 19 | 1 | 4 |
| Harrison R | 1981 | 56.6(1.1) | 53.9(.5) | 62.8(.4) | 60.0(.3) | 65.8(.9) | 61.1(1.6) |
| | | 10 | 39 | 56 | 84 | 6 | 5 |
| Harrison R | 1982 | 55.7(.4) | 53.5(.7) | 55.9(.8) | 57.2(.6) | - | - |
| | | 51 | 15 | 18 | 16 | 0 | 0 |
| Chehalis R | 1982 | 55.2(.4) | 54.0(.9) | 57.9(.5) | 56.4(.5) | 59.6(.3) | - |
| | | 36 | 3 | 29 | 29 | 3 | 0 |
| Waleach | 1982 | 56.7(.7) | 53.8(.9) | 59.2(.4) | 57.4(.4) | - | - |
| | | 7 | 11 | 35 | 47 | (0) | 0 |
| Mainstem | 1982 | 57.8(.9) | 55.0(.5) | 61.3(.6) | 57.2(.4) | - | 63.0(.0) |
| | | 14 | 26 | 17 | 37 | (0) | 1 |
| **Vancouver Island Early Returning Stocks** | | | | | | | |
| Nanaimo R | 1981 | - | - | 60.5(.8) | 59.3(.3) | 62.0(.0) | 62.4(1.1) |
| | | 0 | 0 | 16 | 78 | 1 | 5 |
| Nanaimo R | 1982 | - | 54.4(2.2) | - | 57.8(.4) | - | 61.3(.8) |
| | | 0 | 6 | 0 | 85 | 0 | 8 |
| Puntledge R | 1981 | 54.0(.8) | 54.0(.8) | 60.1(.3) | 57.1(.3) | 62.4(1.0) | 58.4(.9) |
| | | 13 | 17 | 68 | 88 | 7 | 7 |
| Puntledge R | 1982 | 51.8(4.7) | 54.9(.8) | 60.4(.8) | 58.5(.3) | 58.9(2.4) | 61.3(.3) |
| | | 2 | 16 | 10 | 68 | 2 | 2 |
| L. Qualicum | 1981 | 55.7(.6) | 54.6(.4) | 60.1(.4) | 58.5(.4) | 63.3(.6) | 61.6(2.0) |
| | | 32 | 18 | 73 | 70 | 3 | 3 |
| L. Qualicum | 1982 | 56.1(.7) | 54.5(1.1) | 59.1(.4) | 58.7(.4) | 61.2(.8) | 62.3(.3) |
| | | 8 | 5 | 35 | 40 | 8 | 4 |

Table 3 (cont'd)

| Area | Year | Age 3 Male | Age 3 Female | Age 4 Male | Age 4 Female | Age 5 Male | Age 5 Female |
|---|---|---|---|---|---|---|---|
| **Vancouver Island Late Returning Stocks** | | | | | | | |
| Big Qualicum | 1981 | 55.5(.6)<br>36 | 54.5(.5)<br>16 | 61.2(.3)<br>85 | 59.3(.4)<br>53 | 64.7(.9)<br>7 | 64.3(.4)<br>3 |
| Chemainus R | 1981 | 55.9(.9)<br>9 | 52.9(1.0)<br>9 | 59.8(1.3)<br>15 | 58.5(.8)<br>18 | -<br>0 | 62.0(4.0)<br>2 |
| Chemainus R | 1982 | 54.9(.4)<br>45 | 53.2(.7)<br>10 | 58.7(.5)<br>23 | 57.5(.5)<br>18 | 61.8(1.3)<br>2 | -<br>0 |
| Goldstream R | 1982 | 53.8(1.0)<br>8 | 54.8(.7)<br>5 | 58.8(.4)<br>42 | 56.8(.5)<br>28 | 59.9(1.5)<br>4 | 62.5(.7)<br>4 |
| Cowichan R | 1982 | 57.0(.5)<br>36 | 55.4(.5)<br>20 | 60.1(.3)<br>78 | 58.6(.3)<br>62 | 63.8(1.1)<br>4 | -<br>0 |
| Rosewall Cr | 1982 | 56.1(.5)<br>29 | 55.0(.7)<br>14 | 56.9(.5)<br>28 | 56.2(.5)<br>21 | -<br>0 | -<br>0 |
| Nimpkish R | 1982 | 58.2(1.1)<br>9 | 55.8(.6)<br>9 | 59.9(.5)<br>40 | 58.0(.4)<br>29 | -<br>0 | -<br>0 |
| **Mainland Early Returning Stocks** | | | | | | | |
| Sliammon R | 1981 | 52.6(1.0)<br>10 | 54.0(1.7)<br>6 | 57.3(.4)<br>46 | 57.4(.5)<br>31 | 59.7(.9)<br>4 | 60.0(1.0)<br>3 |
| Southgate R | 1982 | 59.4(.7)<br>12 | 60.1(1.8)<br>4 | 63.1(.4)<br>55 | 60.9(.4)<br>30 | 65.9(.9)<br>3 | -<br>0 |
| Okeover R | 1982 | 53.3(.5)<br>28 | 54.0(.4)<br>37 | 56.5(.9)<br>15 | 55.2(.7)<br>19 | 57.6(.9)<br>3 | 55.4(.0)<br>1 |
| Toba R | 1982 | 53.5(.0)<br>1 | -<br>0 | -<br>0 | 59.3(.9)<br>3 | 62.0(.0)<br>1 | -<br>0 |
| **Mainland Late Returning Stocks** | | | | | | | |
| Cheakamus R | 1981 | -<br>0 | -<br>0 | 62.3(.3)<br>73 | 59.6(.6)<br>26 | 66.0(.0)<br>1 | -<br>0 |
| Saltery Bay | 1982 | 56.5(.6)<br>12 | 55.9(.9)<br>6 | 60.0(.6)<br>29 | 59.4(.5)<br>23 | -<br>0 | -<br>0 |
| Tzoonie R | 1982 | 57.2(.9)<br>8 | 55.7(2.5)<br>3 | 61.7(.5)<br>52 | 61.1(.4)<br>40 | -<br>0 | 62.5(1.0)<br>4 |
| Mamquam R | 1982 | 56.7(.5)<br>20 | 60.2(.4)<br>7 | 58.7(.8)<br>45 | 62.2(1.1)<br>19 | 61.3(.7)<br>7 | 3 |
| Indian R | 1982 | 60.9(.0)<br>1 | 59.1(.9)<br>8 | 62.7(.5)<br>14 | 61.5(.5)<br>25 | 64.2(.0)<br>1 | 63.5(.0)<br>1 |

Table 3 (cont'd)

| | | Age | | | | | |
|---|---|---|---|---|---|---|---|
| | | 3 | | 4 | | 5 | |
| Area | Year | Male | Female | Male | Female | Male | Female |
| | | | | Test Fisheries | | | |
| Big Qualicum | 1981 | 55.0(.3)<br>59 | 54.4(.5)<br>39 | 60.2(.2)<br>223 | 58.7(.2)<br>240 | 63.5(2.0)<br>6 | 65.2(.9)<br>4 |
| Big Qualicum | 1982 | 58.9(.6)<br>6 | 53.6(.6)<br>2 | 61.3(.9)<br>7 | 58.7(.6)<br>7 | 62.7(.9)<br>2 | 62.9(.0)<br>1 |
| Nanaimo | 1982 | 56.1(.7)<br>13 | 56.9(.4)<br>11 | 59.0(.7)<br>28 | 57.8(.5)<br>42 | 63.8(.2)<br>2 | 56.6(.0)<br>1 |
| Cowichan | 1982 | 57.0(.4)<br>44 | 55.9(.7)<br>18 | 60.5(.3)<br>54 | 58.9(.3)<br>71 | 65.4(3.0)<br>2 | 60.6(1.4)<br>2 |
| Puntledge | 1982 | 56.3(.6)<br>27 | 56.8(.5)<br>30 | 59.4(.3)<br>99 | 59.2(.3)<br>84 | 64.6(.9)<br>8 | 60.6(.7)<br>7 |
| Fraser R | 1982 | 57.0(.3)<br>126 | 57.4(.3)<br>45 | 60.3(.2)<br>152 | 59.2(.2)<br>161 | 65.0(.7)<br>10 | 63.7(.7)<br>6 |
| Texada Is | 1982 | 56.8(.5) | 57.3(.5) | 59.3(1.1) | 59.7(.4) | 62.0(.0) | 57.4(.0) |

Table 4. Percentage of all chum salmon sampled returning at age 3, 4, and 5. Stocks included are those that were sampled with seines or by dead pitch only.

| | | | Age | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 3 | | | 4 | | | 5 | | |
| Area | Year | N | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| **Fraser River Early Returning Stocks** | | | | | | | | | | | |
| Vedder R | 1981 | 200 | 1.5 | 4.5 | 2.5 | 47.0 | 43.5 | 90.5 | 4.5 | 2.5 | 7.0 |
| Vedder R | 1982 | 100 | 2.0 | 3.0 | 5.0 | 23.0 | 47.0 | 70.0 | 13.0 | 12.0 | 25.0 |
| Blaney Cr | 1982 | 100 | 20.0 | 5.0 | 25.0 | 13.0 | 17.0 | 30.0 | 16.0 | 29.0 | 45.0 |
| Stave R | 1982 | 100 | 6.0 | 10.0 | 16.0 | 19.0 | 62.0 | 81.0 | 1.0 | 2.0 | 3.0 |
| Squakum Cr | 1982 | 100 | 12.0 | 7.0 | 19.0 | 49.0 | 29.0 | 78.0 | 1.0 | 2.0 | 3.0 |
| Total | | 600 | 7.2 | 4.5 | 11.7 | 33.0 | 40.3 | 73.3 | 6.7 | 8.3 | 15.0 |
| **Fraser River Late Returning Stocks** | | | | | | | | | | | |
| Inch Cr | 1981 | 100 | 26.0 | 38.0 | 64.0 | 12.0 | 19.0 | 31.0 | 1.0 | 4.0 | 5.0 |
| Harrison R | 1981 | 200 | 5.0 | 19.5 | 24.5 | 28.0 | 42.0 | 70.0 | 3.0 | 2.5 | 5.5 |
| Harrison R | 1982 | 100 | 51.0 | 15.0 | 66.0 | 18.0 | 16.0 | 34.0 | 0.0 | 0.0 | 0.0 |
| Chehalis R | 1982 | 100 | 36.0 | 3.0 | 39.0 | 29.0 | 29.0 | 58.0 | 3.0 | 0.0 | 3.0 |
| Waleach S | 1982 | 100 | 7.0 | 11.0 | 18.0 | 35.0 | 47.0 | 82.0 | 0.0 | 0.0 | 0.0 |
| Total | | 600 | 21.7 | 17.7 | 39.3 | 25.0 | 32.5 | 57.5 | 1.7 | 1.5 | 3.2 |
| **Vancouver Island Early Returning Stocks** | | | | | | | | | | | |
| Nanaimo R | 1981 | 100 | 0.0 | 0.0 | 0.0 | 16.0 | 78.0 | 94.0 | 1.0 | 5.0 | 6.0 |
| Nanaimo R | 1982 | 99 | 0.0 | 6.1 | 6.1 | 0.0 | 85.9 | 85.9 | 0.0 | 8.0 | 8.0 |
| Puntledge | 1981 | 200 | 6.5 | 8.5 | 15.0 | 34.0 | 44.0 | 78.0 | 3.5 | 3.5 | 7.0 |
| Puntledge | 1982 | 100 | 2.0 | 16.0 | 18.0 | 10.0 | 68.0 | 78.0 | 2.0 | 2.0 | 4.0 |
| L. Qualicum | 1981 | 199 | 16.1 | 9.0 | 25.1 | 37.6 | 35.2 | 71.9 | 1.5 | 1.5 | 3.0 |
| L. Qualicum | 1982 | 100 | 8.0 | 5.0 | 13.0 | 35.0 | 40.0 | 75.0 | 8.0 | 4.0 | 12.0 |
| Total | | 798 | 6.9 | 7.8 | 14.7 | 25.3 | 53.8 | 79.1 | 2.6 | 3.6 | 6.2 |
| **Vancouver Island Late Returning Stocks** | | | | | | | | | | | |
| B. Qualicum | 1981 | 200 | 18.0 | 8.0 | 26.0 | 42.5 | 26.5 | 79.0 | 3.5 | 1.5 | 5.0 |
| Chemainus | 1981 | 53 | 17.0 | 17.0 | 34.0 | 28.3 | 34.0 | 62.3 | 0.0 | 3.8 | 3.8 |
| Chemainus | 1982 | 98 | 45.9 | 10.2 | 56.1 | 23.5 | 18.4 | 41.9 | 2.0 | 0.0 | 2.0 |
| Goldstream | 1982 | 91 | 8.8 | 5.5 | 14.3 | 46.2 | 30.8 | 77.0 | 4.4 | 4.4 | 8.8 |
| Cowichan | 1982 | 200 | 18.0 | 10.0 | 28.0 | 39.0 | 31.0 | 70.0 | 2.0 | 0.0 | 2.0 |
| Rosewall Cr | 1982 | 92 | 31.5 | 15.2 | 46.7 | 30.4 | 22.8 | 53.3 | 0.0 | 0.0 | 0.0 |
| Nimpkish | 1982 | 87 | 10.3 | 10.3 | 20.7 | 46.0 | 33.3 | 79.3 | 0.0 | 0.0 | 0.0 |
| Total | | 821 | 21.0 | 10.1 | 31.1 | 37.9 | 28.1 | 65.8 | 2.1 | 1.1 | 3.2 |

Table 4 (cont'd)

| | | | Age | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 3 | | | 4 | | | 5 | | |
| Area | Year | N | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| **Mainland Early Returning Stocks** | | | | | | | | | | | |
| Sliammon | 1981 | 100 | 10.0 | 6.0 | 16.0 | 46.0 | 31.0 | 77.0 | 4.0 | 3.0 | 7.0 |
| Total | | 100 | 10.0 | 6.0 | 16.0 | 46.0 | 31.0 | 77.0 | 4.0 | 3.0 | 7.0 |
| **Mainland Late Returning Stocks** | | | | | | | | | | | |
| Cheakamus | 1981 | 100 | 0.0 | 0.0 | 0.0 | 73.0 | 2.6 | 99.0 | 1.0 | 0.0 | 1.0 |
| Mamquam | 1982 | 101 | 19.8 | 6.9 | 26.7 | 44.6 | 18.8 | 63.4 | 6.9 | 3.0 | 9.9 |
| Indian R | 1982 | 50 | 2.0 | 16.0 | 18.0 | 28.0 | 50.0 | 78.0 | 2.0 | 2.0 | 4.0 |
| Total | | 251 | 8.4 | 6.0 | 14.3 | 52.6 | 27.9 | 80.5 | 3.6 | 1.6 | 5.2 |

Table 5. Percentage age composition of chum salmon test fisheries during 1981-82.

| Date | Age 3 | Age 4 | Age 5 | Number sampled |
|---|---|---|---|---|
| | | Big Qualicum 1981 | | |
| October 21-24 | 11.3 | 87.1 | 1.6 | 186 |
| October 29-30 | 20.6 | 77.9 | 1.5 | 68 |
| November 4-6 | 22.6 | 76.7 | 0.7 | 146 |
| November 10-13 | 19.4 | 78.7 | 1.9 | 155 |
| | | Big Qualicum 1982 | | |
| November 12 | 30.4 | 56.5 | 13.0 | 23 |
| | | Upper Johnstone Strait 1982 | | |
| September 4 | 11.4 | 82.9 | 5.7 | 105 |
| September 10 | 4.1 | 85.6 | 10.3 | 97 |
| September 17 | 10.1 | 82.8 | 7.1 | 99 |
| September 23 | 12.0 | 79.0 | 9.0 | 100 |
| October 2 | 28.1 | 68.4 | 3.5 | 114 |
| October 7 | 28.4 | 69.0 | 2.6 | 116 |
| October 15 | 24.1 | 73.3 | 2.6 | 116 |
| October 21 | 28.6 | 69.0 | 2.4 | 42 |
| October 28 | 31.0 | 67.3 | 1.7 | 113 |
| | | Puntledge (Cape Lazo) 1982 | | |
| October 13 | 16.7 | 70.8 | 12.5 | 48 |
| October 19 | 23.2 | 73.7 | 3.1 | 99 |
| October 29 | 19.6 | 73.9 | 6.5 | 46 |
| November 1 | 29.8 | 59.6 | 1.8 | 57 |
| | | West Coast Texada Island 1982 | | |
| November 1 | 41.9 | 55.8 | 2.3 | 43 |
| November 12 | 45.5 | 53.0 | 1.8 | 66 |
| | | Fraser River (Albion site) 1982 | | |
| October 6 | 12.2 | 79.6 | 8.2 | 49 |
| October 14 | 22.0 | 68.0 | 10.0 | 50 |
| October 20 | 22.4 | 67.3 | 10.2 | 49 |
| October 27 | 35.4 | 64.6 | 0.0 | 48 |
| November 3 | 34.0 | 66.0 | 0.0 | 50 |
| November 12 | 36.7 | 63.3 | 0.0 | 49 |
| November 19 | 34.0 | 64.0 | 2.0 | 50 |
| November 25 | 49.0 | 51.0 | 0.0 | 49 |
| December 3 | 51.0 | 49.0 | 0.0 | 49 |
| December 9 | 44.7 | 55.3 | 0.0 | 47 |

Table 5 (cont'd)

| Date | Age 3 | Age 4 | Age 5 | Number sampled |
|---|---|---|---|---|
| | | Nanaimo 1982 | | |
| November 10 | 24.7 | 72.2 | 3.1 | 97 |
| | | Cowichan (Satellite Channel) 1982 | | |
| October 29 | 33.9 | 64.5 | 1.6 | 67 |
| November 3 | 26.7 | 73.3 | 0.0 | 75 |
| November 10 | 35.0 | 61.2 | 4.1 | 49 |

Table 6. Frequencies of numbers of gill rakers on left most anterior gill arch for chum salmon sampled during 1981-82.

| Location | N | Number of gill rakers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| **Fraser River early returning stocks** | | | | | | | | | | | |
| Vedder R | 300 | 0 | 0 | 3 | 15 | 49 | 80 | 118 | 31 | 3 | 1 |
| Stave R | 100 | 0 | 0 | 0 | 8 | 26 | 30 | 25 | 10 | 1 | 0 |
| Blaney Cr | 100 | 0 | 0 | 03 | 11 | 18 | 40 | 20 | 6 | 2 | 0 |
| Squakum Cr | 125 | 0 | 0 | 4 | 17 | 26 | 45 | 28 | 5 | 0 | 0 |
| Weaver Cr | 100 | 0 | 0 | 2 | 4 | 22 | 34 | 29 | 8 | 1 | 0 |
| Total | 725 | 0 | 0 | 12 | 55 | 141 | 229 | 220 | 60 | 7 | 1 |
| % | | 0.0 | 0.0 | 1.7 | 7.6 | 19.4 | 31.6 | 30.3 | 8.3 | 1.0 | 0.0 |
| **Fraser River late returning stocks** | | | | | | | | | | | |
| Mainstem | 95 | 0 | 0 | 1 | 3 | 17 | 31 | 39 | 4 | 0 | 0 |
| Waleach | 100 | 0 | 0 | 0 | 0 | 14 | 27 | 38 | 14 | 6 | 1 |
| Chehalis R | 100 | 0 | 0 | 0 | 0 | 16 | 27 | 43 | 11 | 3 | 0 |
| Harrison R | 300 | 0 | 0 | 1 | 5 | 42 | 99 | 116 | 31 | 6 | 0 |
| Inch Cr | 100 | 0 | 0 | 0 | 4 | 8 | 36 | 38 | 13 | 1 | 0 |
| Total | 695 | 0 | 0 | 2 | 12 | 97 | 220 | 274 | 73 | 16 | 1 |
| % | | 0.0 | 0.0 | 0.3 | 1.7 | 14.0 | 31.7 | 39.4 | 10.5 | 2.3 | 0.0 |
| **Vancouver Island early returning stocks** | | | | | | | | | | | |
| Nanaimo R | 200 | 2 | 0 | 5 | 19 | 74 | 48 | 40 | 12 | 0 | 0 |
| Little Qualicum R | 300 | 0 | 0 | 0 | 17 | 94 | 104 | 63 | 21 | 1 | 0 |
| Puntledge R | 300 | 0 | 1 | 2 | 31 | 94 | 86 | 71 | 14 | 1 | 0 |
| Total | 800 | 2 | 1 | 7 | 67 | 262 | 238 | 174 | 47 | 2 | 0 |
| % | | 0.3 | 0.1 | 0.9 | 8.4 | 32.8 | 29.8 | 21.8 | 5.9 | 0.3 | 0 |
| **Vancouver Island late returning stocks** | | | | | | | | | | | |
| Goldstream R | 92 | 0 | 0 | 2 | 6 | 35 | 27 | 19 | 3 | 0 | 0 |
| Cowichan River | 200 | 0 | 0 | 2 | 14 | 63 | 58 | 48 | 14 | 1 | 0 |
| Chemainus R | 153 | 0 | 0 | 3 | 17 | 32 | 50 | 42 | 9 | 0 | 0 |
| Big Qualicum R | 200 | 0 | 0 | 0 | 4 | 39 | 80 | 66 | 11 | 0 | 0 |
| Rosewall Cr | 92 | 0 | 0 | 2 | 3 | 18 | 12 | 39 | 16 | 2 | 0 |
| Nimpkish R | 87 | 0 | 0 | 0 | 0 | 3 | 16 | 32 | 33 | 3 | 0 |
| Total | 824 | 0 | 0 | 9 | 44 | 190 | 243 | 246 | 86 | 6 | 0 |
| % | | 0.0 | 0.0 | 1.1 | 5.3 | 23.1 | 29.5 | 29.9 | 10.4 | 0.7 | 0.0 |
| **Mainland early returning stocks** | | | | | | | | | | | |
| Southgate R | 104 | 0 | 4 | 7 | 19 | 29 | 29 | 13 | 3 | 0 | 0 |
| Toba R | 5 | 0 | 0 | 0 | 0 | | 1 | 3 | 0 | 0 | 0 |
| Okeover Cr | 103 | 0 | 5 | 5 | 13 | 38 | 25 | 17 | 0 | 0 | 0 |
| Sliammon R | 100 | 0 | 0 | 1 | 6 | 32 | 35 | 21 | 5 | 0 | 0 |
| Saltery Bay Cr | 70 | 0 | 0 | 0 | 7 | 19 | 23 | 17 | 3 | 0 | 1 |
| Total | 382 | 0 | 9 | 13 | 45 | 119 | 113 | 71 | 11 | 0 | 1 |
| % | | 0.0 | 2.4 | 3.4 | 11.8 | 31.2 | 29.6 | 18.6 | 2.8 | 0.0 | 0.3 |

Table 6 (cont'd).

| Location | N | Number of gill rakers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| Mainland late returning stocks | | | | | | | | | | | |
| Tzoonie R | 107 | 0 | 0 | 0 | 3 | 11 | 39 | 38 | 15 | 1 | 0 |
| Cheakamus R | 100 | 0 | 1 | 1 | 6 | 18 | 26 | 37 | 8 | 2 | 1 |
| Mamquam R | 101 | 0 | 1 | 5 | 24 | 33 | 25 | 13 | 0 | 0 | 0 |
| Indian R | 50 | 0 | 0 | 1 | 2 | 7 | 17 | 13 | 8 | 1 | 1 |
| Total | 358 | 0 | 2 | 7 | 35 | 69 | 107 | 101 | 31 | 4 | 2 |
| % | | 0.0 | 0.6 | 2.0 | 9.8 | 19.3 | 29.9 | 28.2 | 8.7 | 1.1 | 0.6 |

Table 7. Mean number of gill rakers on left most anterior gill arch for chum salmon brood years 1976-1979. Standard deviations are in parenthesis.

| Location | N | Mean | Brood year N | 1976 | N | 1977 | N | 1978 | N | 1979 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Fraser River early returning stocks** | | | | | | | | | | |
| Vedder R | 300 | 22.4(.1) | 14 | 22.4(.3) | 206 | 22.4 (.1) | 75 | 22.2(.1) | 5 | 21.8(.6) |
| Stave R | 100 | 22.1(.1) | 0 | - | 3 | 22.7 (.7) | 81 | 22.1(.1) | 16 | 21.8(.3) |
| Blaney Cr | 100 | 21.9(.1) | - | - | 45 | 22.0 (.2) | 30 | 21.8(.2) | 25 | 21.9(.2) |
| Squakum Cr | 125 | 21.7(.1) | 1 | 22.0(.0) | 21 | 22.1 (.2) | 84 | 21.6(.1) | 19 | 21.7(.3) |
| Weaver Cr | 100 | 22.1(.1) | 5 | 23.0(.3) | 63 | 22.0 (.2) | 32 | 22.2(.2) | 0 | - |
| Total | 725 | 22.1(.1) | 20 | 22.5(.3) | 338 | 22.3 (.2) | 302 | 22.0(.1) | 65 | 21.8(.2) |
| **Fraser River late returning stocks** | | | | | | | | | | |
| Mainstem | 95 | 22.2(.1) | 0 | - | 1 | 21.0 (.0) | 54 | 22.0(.1) | 40 | 22.5(.1) |
| Waleach | 100 | 22.7(.1) | 0 | - | 0 | - | 82 | 22.7(.1) | 18 | 23.1(.4) |
| Chehalis R | 100 | 22.6(.1) | 0 | - | 3 | 22.7 (.9) | 58 | 22.4(.1) | 39 | 22.8(.2) |
| Harrison R | 300 | 22.5(.1) | 11 | 22.2(.2) | 140 | 22.4 (.1) | 83 | 22.5(.1) | 66 | 22.7(.1) |
| Inch Cr | 100 | 22.5(.1) | 5 | 23.2(.2) | 31 | 22.2 (.2) | 64 | 22.6(.1) | 0 | - |
| Total | 695 | 22.5(.1) | 16 | 22.5(.2) | 175 | 22.4 (.2) | 341 | 22.5(.1) | 163 | 22.7(.1) |
| **Vancouver Island early returning stocks** | | | | | | | | | | |
| Nanaimo R | 200 | 21.6(.1) | 6 | 21.8(.4) | 102 | 22.0 (.1) | 86 | 21.1(.1) | 6 | 22.0(.6) |
| Little Qualicum R | 300 | 21.9(.1) | 6 | 22.8(.5) | 156 | 21.8 (.1) | 125 | 22.0(.1) | 13 | 22.2(.4) |
| Puntledge R | 300 | 21.8(.1) | 14 | 22.3(.3) | 160 | 21.8 (.1) | 108 | 21.7(.1) | 18 | 21.6(.4) |
| Total | 800 | 21.8(.1) | 26 | 22.3(.3) | 418 | 21.8 (.1) | 319 | 21.7(.1) | 37 | 21.9(.4) |
| **Vancouver Island late returning stocks** | | | | | | | | | | |
| Goldstream R | 91 | 21.7(.1) | 0 | - | 8 | 22.0 (.3) | 70 | 21.7(.1) | 13 | 21.7(.4) |
| Cowichan R | 200 | 21.9(.1) | - | - | 4 | 21.8 (.5) | 140 | 21.8(.1) | 56 | 22.1(.2) |
| Chemainus R | 151 | 21.9(.1) | 2 | 22.5(.5) | 35 | 22.6 (.1) | 59 | 21.8(.2) | 55 | 21.5(.1) |
| Big Qualicum | 200 | 22.2(.1) | 10 | 22.7(.2) | 138 | 22.3 (.1) | 52 | 21.9(.1) | 0 | - |
| Rosewall Cr | 92 | 22.5(.1) | 0 | - | 0 | - | 49 | 22.9(.2) | 43 | 22.1(.2) |
| Nimpkish R | 87 | 23.2(.1) | 0 | - | 0 | - | 69 | 23.3(.1) | 18 | 22.9(.2) |
| Total | 821 | 22.2(.1) | 12 | 22.7(.2) | 185 | 22.3 (.1) | 439 | 22.2(.1) | 185 | 22.0(.2) |
| **Mainland early returning stocks** | | | | | | | | | | |
| Southgate R | 104 | 21.2(.1) | 0 | - | 3 | 22.0(1.0) | 85 | 21.2(.1) | 16 | 21.0(.3) |
| Toba R | 5 | 22.4(.4) | 0 | - | 1 | 23.0 (.0) | 3 | 22.0(.4) | 1 | 23.0(.0) |
| Okeover R | 103 | 21.2(.1) | - | 0 | 4 | 21.3 (.3) | 34 | 21.0(.2) | 65 | 21.3(.2) |
| Sliammon R | 100 | 21.8(.1) | 7 | 22.3(.4) | 77 | 21.8 (.1) | 16 | 21.9(.3) | 0 | - |
| Saltery Bay Cr | 70 | 21.9(.1) | 0 | - | 0 | - | 52 | 21.8(.2) | 18 | 22.3(.2) |
| Total | 382 | 21.5(.1) | 7 | 22.3(.4) | 85 | 21.8 (.1) | 190 | 21.4(.2) | 100 | 21.4(.2) |

Table 7 (cont'd)

| Location | N | Mean | Brood year | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | N | 1976 | N | 1977 | N | 1978 | N | 1979 |
| **Mainland late returning stocks** | | | | | | | | | | |
| Tzonnie R | 107 | 22.5(.1) | 0 | - | 4 | 22.8 (.5) | 92 | 22.5(.1) | 11 | 22.1(.3) |
| Cheakamus R | 100 | 22.3(.1) | 1 | 23.0(.0) | 99 | 22.3 (.1) | 0 | - | 0 | - |
| Mamquam R | 101 | 21.1(.1) | 0 | - | 2 | 22.0 (.4) | 64 | 21.0(.1) | 27 | 21.3(.2) |
| Indian R | 50 | 22.4(.2) | 0 | - | 2 | 22.0(1.0) | 39 | 22.4(.2) | 9 | 22.8(.5) |
| Total | 358 | 22.0(.1) | 1 | 23.0(.0) | 115 | 22.2 (.1) | 195 | 22.0(.1) | 47 | 21.8(.2) |

Table 8. Mean number of branchiostegal rays on left side for male and female chum salmon sampled in southern British Columbia during 1981-82.

| Location | Males | | Females | |
|---|---|---|---|---|
| | N | Mean | N | Mean |
| **Fraser River early returning stocks** | | | | |
| Vedder R | 144 | 13.2 ( .8) | 156 | 13.5 ( .8) |
| Stave R | 26 | 13.1 ( .8) | 74 | 13.7 ( .8) |
| Blaney Cr | 49 | 13.2 ( .7) | 51 | 13.4 ( .7) |
| Squakum Cr | 74 | 13.3 ( .8) | 51 | 13.5 ( .7) |
| Weaver Cr | 65 | 13.4 ( .8) | 35 | 13.2 ( .9) |
| Total | 358 | 13.2 (1.2) | 367 | 13.5 (1.2) |
| **Fraser River late returning stocks** | | | | |
| Mainstem | 31 | 13.1 ( .8) | 64 | 13.0 ( .9) |
| Waleach S | 42 | 13.1 ( .6) | 58 | 13.3 ( .8) |
| Chehalis R | 68 | 13.4 ( .7) | 32 | 13.3 ( .7) |
| Harrison R | 141 | 13.3 ( .7) | 159 | 13.5 ( .8) |
| Inch Cr | 39 | 13.3 ( .8) | 61 | 13.3 ( .8) |
| Total | 321 | 13.3 (1.2) | 374 | 13.3 (1.3) |
| **Vancouver Island early returning stocks** | | | | |
| Nanaimo R | 17 | 12.8 ( .9) | 183 | 13.2 ( .8) |
| Little Qualicum R | 160 | 13.1 (1.0) | 140 | 12.8 ( .9) |
| Puntledge R | 102 | 12.8 (1.0) | 198 | 13.1 (1.0) |
| Total | 279 | 13.0 (1.4) | 521 | 13.1 (1.2) |
| **Vancouver Island late returning stocks** | | | | |
| Goldstream R | 55 | 12.8 ( .8) | 37 | 12.8 (1.0) |
| Cowichan R | 118 | 12.3 ( .9) | 82 | 12.8 (1.1) |
| Chemainus R | 96 | 13.3 ( .7) | 57 | 13.1 ( .7) |
| Big Qualicum R | 128 | 12.7 ( .8) | 72 | 12.9 ( .8) |
| Rosewall Cr | 57 | 13.1 (1.1) | 35 | 13.2 ( .9) |
| Nimpkish R | 47 | 13.5 ( .7) | 38 | 13.3 ( .8) |
| Total | 501 | 12.9 (1.3) | 321 | 13.0 (1.3) |
| **Mainland early returning stocks** | | | | |
| Southgate R | 70 | 13.2 ( .7) | 34 | 13.6 ( .7) |
| Toba R | 2 | 13.5 ( .5) | 3 | 14.0 ( .0) |
| Okeover Cr | 46 | 13.0 ( .6) | 57 | 13.4 ( .7) |
| Sliammon R | 60 | 13.1 ( .8) | 40 | 13.1 (1.0) |
| Saltery Bay Cr | 29 | 13.0 (1.0) | 68 | 13.4 ( .7) |
| Total | 207 | 13.1 (1.0) | 202 | 13.4 ( .8) |

Table 8 (cont'd).

| Location | Males | | Females | |
|---|---|---|---|---|
| | N | Mean | N | Mean |
| Mainland late returning stocks | | | | |
| Tzoonie R | 60 | 13.5 (1.0) | 47 | 13.7 ( .9) |
| Cheakamus R | 74 | 13.2 ( .7) | 26 | 12.9 ( .9) |
| Mamquam R | 72 | 13.0 ( .7) | 29 | 13.3 ( .7) |
| Indian R. | 16 | 13.7 (1.0) | 34 | 13.5 ( .9) |
| Total | 222 | 13.3 (1.3) | 136 | 13.4 (1.2) |

Table 9. Male chum salmon mean postorbital head length (cm), caudal peduncle depth (cm), anal fin base length (cm), anal fin height (cm), dorsal fin base length (cm), and dorsal fin height for salmon sampled during 1981-1982. Measurements for each individual were standardized to 58.7 cm postorbital-hypural length. Standard deviation is in parenthesis.

| Area | N | Head | Caudal depth | Anal base | Anal height | Dorsal base | Dorsal height |
|---|---|---|---|---|---|---|---|
| **Fraser River early returning stocks** | | | | | | | |
| Vedder R | 144 | 9.5(.5) | 5.0(.3) | 8.1(.5) | 7.2(.5) | 7.6(.7) | 10.7( .9) |
| Stave R | 26 | 9.5(.5) | 4.7(.3) | 8.0(.5) | 7.0(.4) | 7.4(.7) | 10.2( .7) |
| Blaney Cr | 49 | 9.5(.4) | 4.6(.3) | 7.6(.5) | 6.9(.5) | 7.1(.6) | 10.1( .9) |
| Squakaum Cr | 74 | 9.4(.5) | 4.8(.4) | 8.0(.6) | 6.9(.5) | 7.3(.6) | 9.9( .7) |
| Weaver Cr | 65 | 9.5(.6) | 4.7(.4) | 7.9(.6) | 7.1(.6) | 7.1(.8) | 10.0(1.2) |
| **Fraser River late returning stocks** | | | | | | | |
| Mainstem | 31 | 10.0(.4) | 5.4(.3) | 8.6(.5) | 7.5(.4) | 8.3(.7) | 10.8(1.0) |
| Waleach S | 42 | 9.8(.5) | 5.0(.4) | 8.3(.4) | 7.3(.7) | 7.6(.7) | 10.4(1.1) |
| Chehalis R | 68 | 9.4(.4) | 4.7(.3) | 8.1(.6) | 7.0(.5) | 7.3(.7) | 9.8( .8) |
| Harrison R | 141 | 9.4(.8) | 4.8(.3) | 7.9(.5) | 7.1(.5) | 7.6(.7) | 10.3(1.0) |
| Inch Cr | 39 | 9.3(.4) | 4.6(.3) | 7.6(.5) | 6.8(.5) | 7.1(.6) | 10.0(0.6) |
| **Vancouver Island early returning stocks** | | | | | | | |
| Nanaimo R | 17 | 9.4(.4) | 5.1(.3) | 7.9(.4) | 7.0(.5) | 7.9(.5) | 10.0(0.5) |
| Little Qualicum R | 160 | 9.2(.4) | 4.7(.3) | 7.8(.5) | 6.7(.5) | 7.1(.7) | 10.4(1.1) |
| Puntledge R | 102 | 9.4(.5) | 4.9(.4) | 7.9(.6) | 6.9(.6) | 7.2(.7) | 10.4(1.3) |
| **Vancouver Island late returning stocks** | | | | | | | |
| Goldstream R | 55 | 9.1(.4) | 4.7(.7) | 7.6(.5) | 6.5(.4) | 7.2(.7) | 10.3(1.0) |
| Cowichan R | 118 | 9.5(.4) | 4.7(.3) | 7.8(.5) | 6.9(.5) | 7.9(.6) | 11.2( .8) |
| Chemainus R | 96 | 9.5(.3) | 4.7(.3) | 7.8(.7) | 6.9(.4) | 7.0(.7) | 9.9( .8) |
| Big Qualicum R | 128 | 9.1(.5) | 4.8(.3) | 7.6(.6) | 6.6(.5) | 7.3(.6) | 10.3( .8) |
| Rosewall Cr | 57 | 9.6(.3) | 4.6(.3) | 7.7(.6) | 7.0(.5) | 7.5(.6) | 10.3( .8) |
| Nimpkish R | 49 | 9.2(.5) | 4.5(.5) | 7.6(.5) | 6.4(.9) | 7.1(.6) | 9.9( .7) |
| **Mainland early returning stocks** | | | | | | | |
| Southgate R | 70 | 9.3(.4) | 4.9(.3) | 7.6(.4) | 7.1(.4) | 7.6(.6) | 10.7(1.0) |
| Okeover R | 46 | 9.3(.4) | 4.7(.3) | 7.9(.4) | 6.7(.4) | 6.8(.6) | 9.5( .8) |
| Sliammon R | 60 | 9.2(.6) | 4.4(.4) | 7.8(.5) | 6.6(.8) | 7.1(.6) | 10.2( .8) |
| Saltery Bay Cr | 41 | 9.1(.5) | 4.4(.2) | 7.1(.6) | 7.1(.5) | 7.3(.7) | 10.5( .9) |
| **Mainland late returning stocks** | | | | | | | |
| Tzoonie R | 60 | 9.1(.4) | 4.5(.2) | 7.3(.5) | 7.3(.5) | 8.1(.6) | 11.3(1.1) |
| Cheakamus R | 74 | 9.3(.5) | 4.7(.3) | 7.9(.5) | 6.8(.6) | 7.8(.6) | 10.6( .9) |
| Mamquam R | 72 | 9.6(.5) | 5.1(.3) | 8.1(.5) | 6.9(.4) | 7.7(.6) | 10.4( .9) |
| Indian R | 16 | 10.1(.4) | 5.5(.2) | 8.8(.5) | 7.5(.4) | 8.8(.6) | 11.0( .7) |

Table 10. Female chum salmon mean postorbital head length (cm), caudal peduncle depth (cm), anal fin base length, anal fin height, dorsal fin base length, and dorsal fin height for salmon sampled during 1981-1982. Measurements for each individual were standardized to 58.7cm postorbital-hypural length. Standard deviation is in parenthesis.

| Area | N | Head | Caudal depth | Anal base | Anal height | Dorsal base | Dorsal height |
|---|---|---|---|---|---|---|---|
| **Fraser River early returning stocks** | | | | | | | |
| Vedder R | 156 | 8.8(.4) | 4.8(.4) | 8.2(.5) | 7.1(.5) | 6.8(.6) | 9.7( .8) |
| Stave R | 74 | 8.6(.4) | 4.7(.4) | 8.2(.5) | 7.0(.6) | 6.7(.5) | 9.5( .6) |
| Blaney Cr | 51 | 8.7(.4) | 4.5(.3) | 7.8(.4) | 7.2(.3) | 6.6(.6) | 9.4( .9) |
| Squakum Cr | 51 | 8.6(.5) | 4.7(.4) | 8.0(.6) | 6.8(.7) | 6.7(.5) | 9.2( .7) |
| Weaver Cr | 35 | 8.6(.7) | 4.7(.5) | 8.3(.7) | 7.2(.6) | 6.7(.7) | 9.3( .8) |
| **Fraser River late returning stocks** | | | | | | | |
| Mainstem | 64 | 9.4(.4) | 5.2(.3) | 8.8(.5) | 7.7(.5) | 7.5(.6) | 9.9( .8) |
| Waleach S | 58 | 8.7(.4) | 4.7(.4) | 8.3(.5) | 7.0(.5) | 6.8(.6) | 9.1( .7) |
| Chehalis R | 32 | 8.7(.4) | 4.8(.4) | 8.1(.6) | 6.8(.b) | 6.7(.5) | 9.1( .5) |
| Harrison R | 159 | 8.8(.4) | 4.5(.3) | 8.0(.5) | 7.1(.5) | 6.8(.6) | 9.3( .8) |
| Inch Cr | 61 | 8.7(.5) | 4.2(.3) | 8.0(.5) | 7.2(.5) | 6.5(.6) | 9.1( .7) |
| **Vancouver Island early returning stocks** | | | | | | | |
| Nanaimo R | 183 | 8.5(.5) | 4.7(.4) | 8.0(.6) | 6.7(.6) | 6.7(.8) | 8.8( .8) |
| Little Qualicum R | 140 | 8.6(.4) | 4.6(.3) | 7.9(.5) | 6.6(.6) | 6.7(.7) | 9.8( .9) |
| Puntledge R | 198 | 8.6(.4) | 4.6(.4) | 8.0(.5) | 7.1(.5) | 6.4(.6) | 9.1( .8) |
| **Vancouver Island late returning stocks** | | | | | | | |
| Goldstream R | 37 | 8.5(.4) | 4.6(.4) | 7.8(.9) | 7.0(.6) | 6.8(.8) | 9.7( .9) |
| Cowichan R | 82 | 8.7(.4) | 4.7(.3) | 8.1(.6) | 6.9(.8) | 7.1(.6) | 10.1(1.0) |
| Chemainus R | 57 | 8.7(.4) | 4.6(.3) | 8.0(.4) | 6.9(.4) | 6.5(.5) | 9.2( .9) |
| Big Qualicum R | 72 | 8.4(.5) | 4.6(.3) | 7.7(.6) | 6.6(.6) | 6.4(.6) | 9.0( .7) |
| Rosewall Cr | 35 | 8.5(.3) | 4.3(.2) | 8.0(.6) | 7.1(.4) | 6.4(.6) | 9.0( .8) |
| Nimpkish R | 38 | 8.6(.4) | 4.3(.2) | 7.7(.6) | 6.3(.7) | 7.0(.6) | 8.4( .6) |
| **Mainland early returning stocks** | | | | | | | |
| Southgate R | 34 | 8.4(.3) | 4.5(.2) | 7.5(.5) | 7.0(.6) | 6.8(.5) | 9.9( .9) |
| Okeover Cr | 57 | 8.8(.4) | 4.4(.3) | 7.8(.5) | 6.7(.6) | 6.1(.5) | 8.7( .6) |
| Sliammon R | 60 | 8.4(.5) | 4.3(.3) | 7.7(.4) | 6.7(.6) | 6.4(.6) | 9.2( .8) |
| Saltery Bay Cr | 29 | 8.6(.4) | 4.3(.2) | 7.2(.5) | 7.1(.4) | 6.7(.7) | 9.8( .7) |
| **Mainland late returning stocks** | | | | | | | |
| Tzoonie R | 47 | 8.4(.4) | 4.4(.3) | 7.2(.6) | 7.4(.7) | 7.4(.7) | 10.5( .9) |
| Cheakamus R | 26 | 8.5(.3) | 4.7(.4) | 8.1(.3) | 6.7(.4) | 6.8(.5) | 9.7( .7) |
| Mamquam R | 29 | 9.0(.4) | 4.9(.3) | 8.2(.4) | 7.0(.3) | 6.8(.6) | 9.4( .8) |
| Indian R | 34 | 9.1(.6) | 5.2(.4) | 8.3(.4) | 7.2(.5) | 8.0(.8) | 10.6(1.0) |

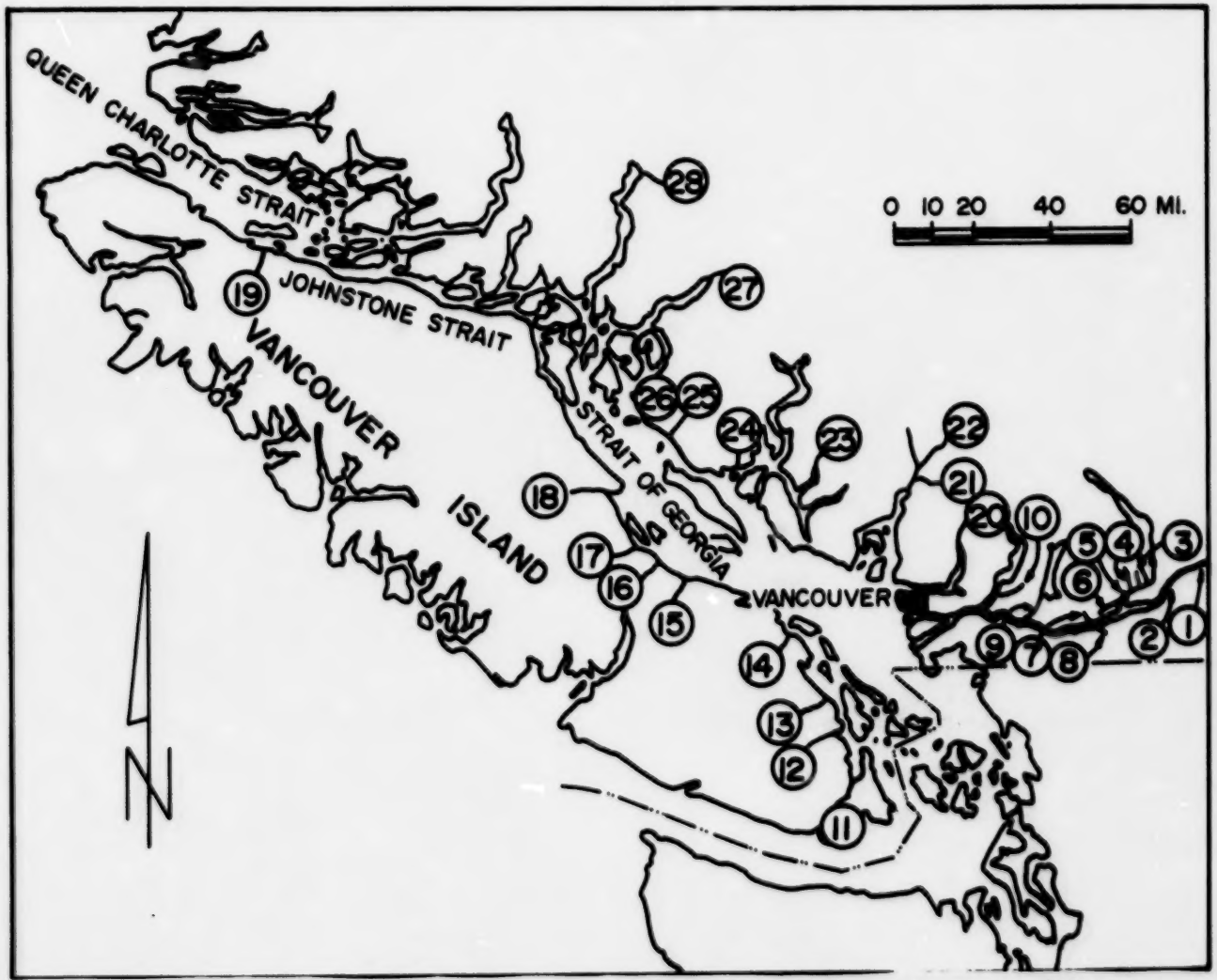


Fig. 1. Location of stocks sampled in 1981 and 1982. Listed in ascending order are: (1) Mainstem Fraser R., (2) Waleach Slough, (3) Weaver Cr., (4) Chehalis R., (5) Harrison R., (6) Squakum Cr., (7) Inch Cr., (8) Vedder R., (9) Stave R., (10) Blaney Cr., (11) Goldstream R., (12) Cowichan R., (13) Chemainus R., (14) Nanaimo R., (15) Little Qualicum R., (16) Big Qualicum R., (17) Rosewall Cr., (18) Puntledge R., (19) Nimpkish R., (20) Indian R., (21) Mamquam R., (22) Cheakamus R., (23) Tzoonie R., (24) Saltery Bay Cr., (25) Sliammon R., (26) Okeover R., (27) Toba R., (28) Southgate R.

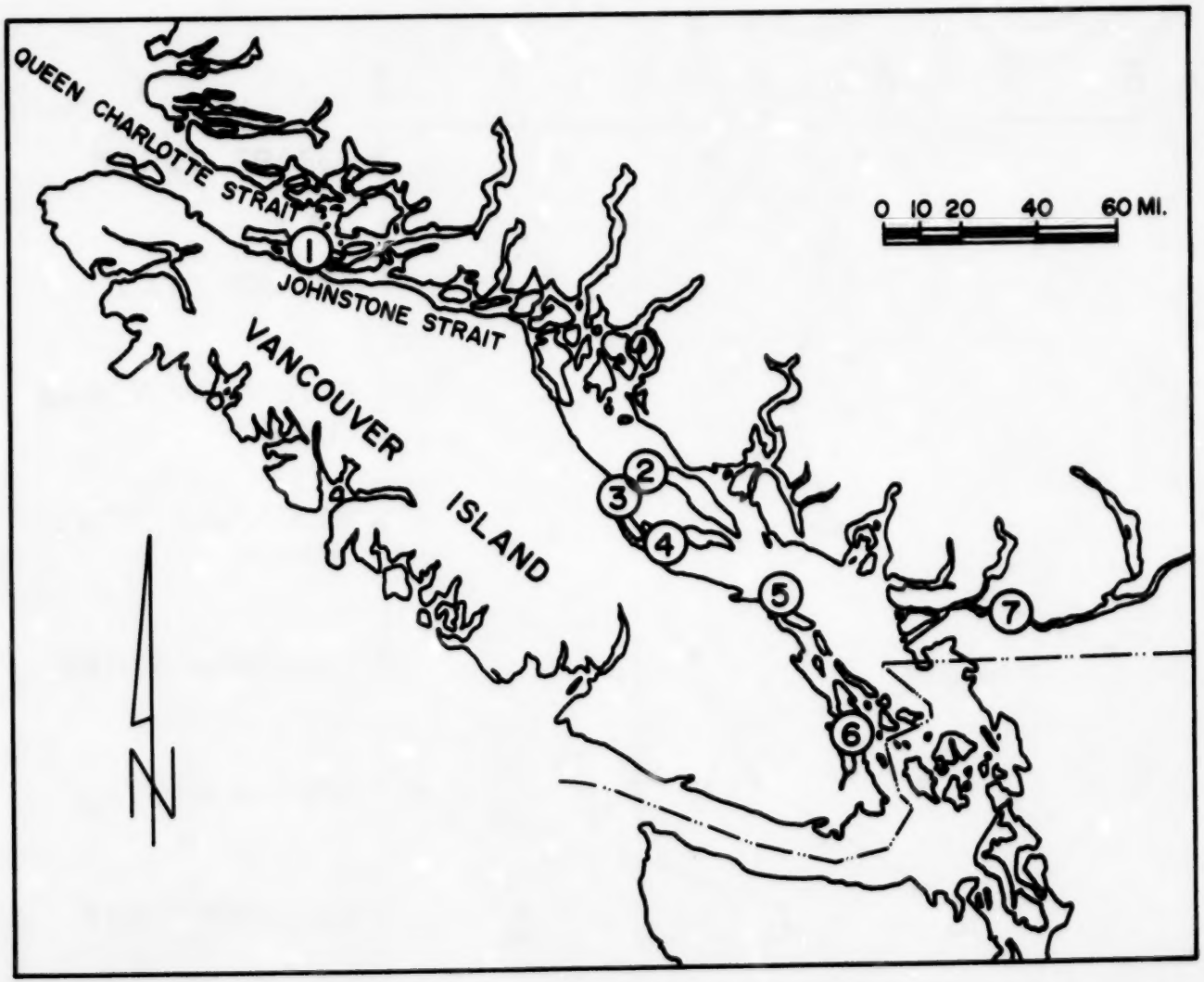


Fig. 2. Location of test fisheries sampled in 1981 and 1982. Listed in ascending order are: (1) upper Johnstone Strait, (2) Texada Island, (3) Puntledge (Cape Lazo), (4) Big Qualicum, (5) Nanaimo, (6) Cowichan (Satellite Channel), (7) Fraser River (Albion).

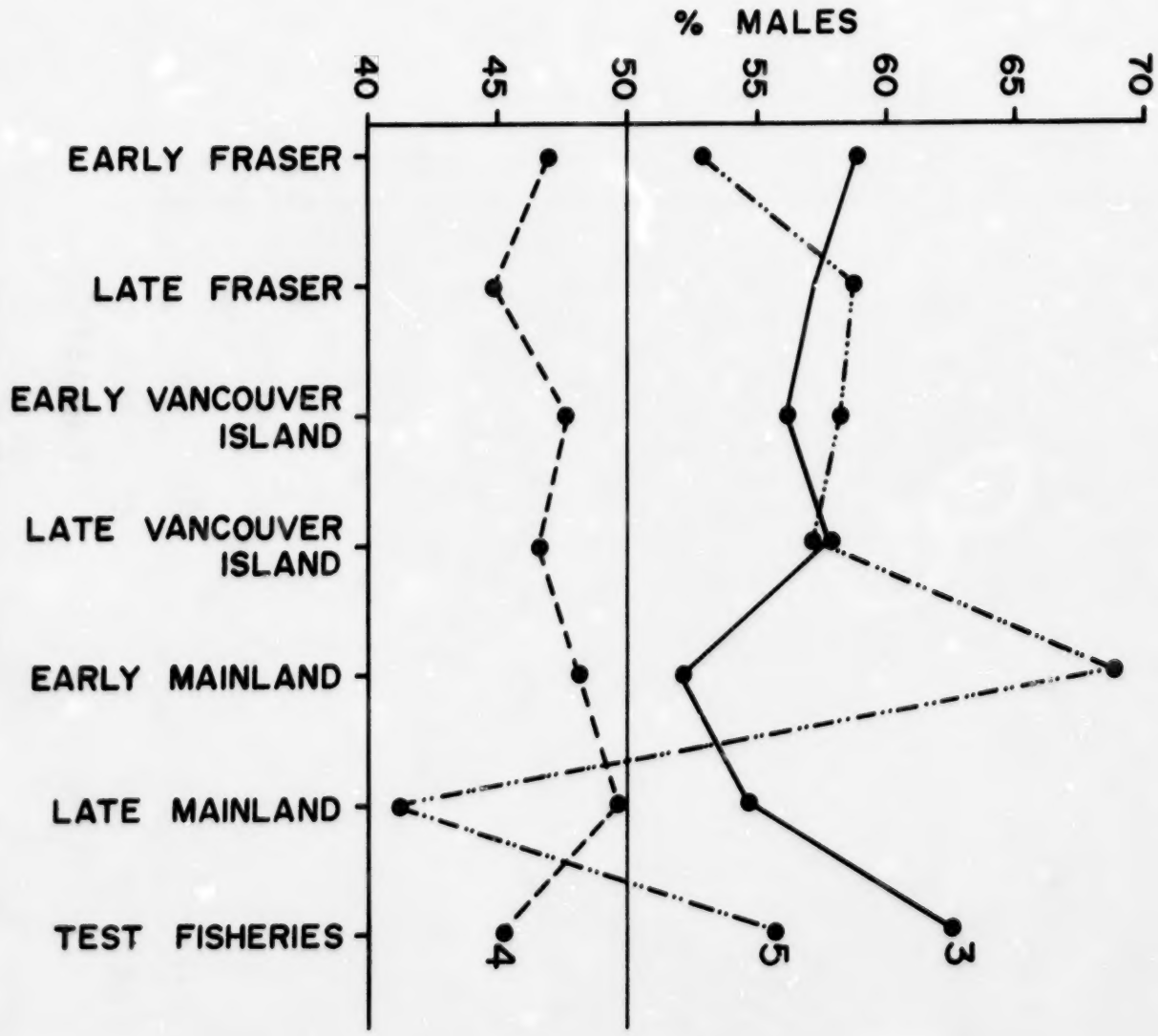


Fig. 3. Percentage of male chum salmon at ages 3, 4, and 5 on spawning grounds and in test fisheries.

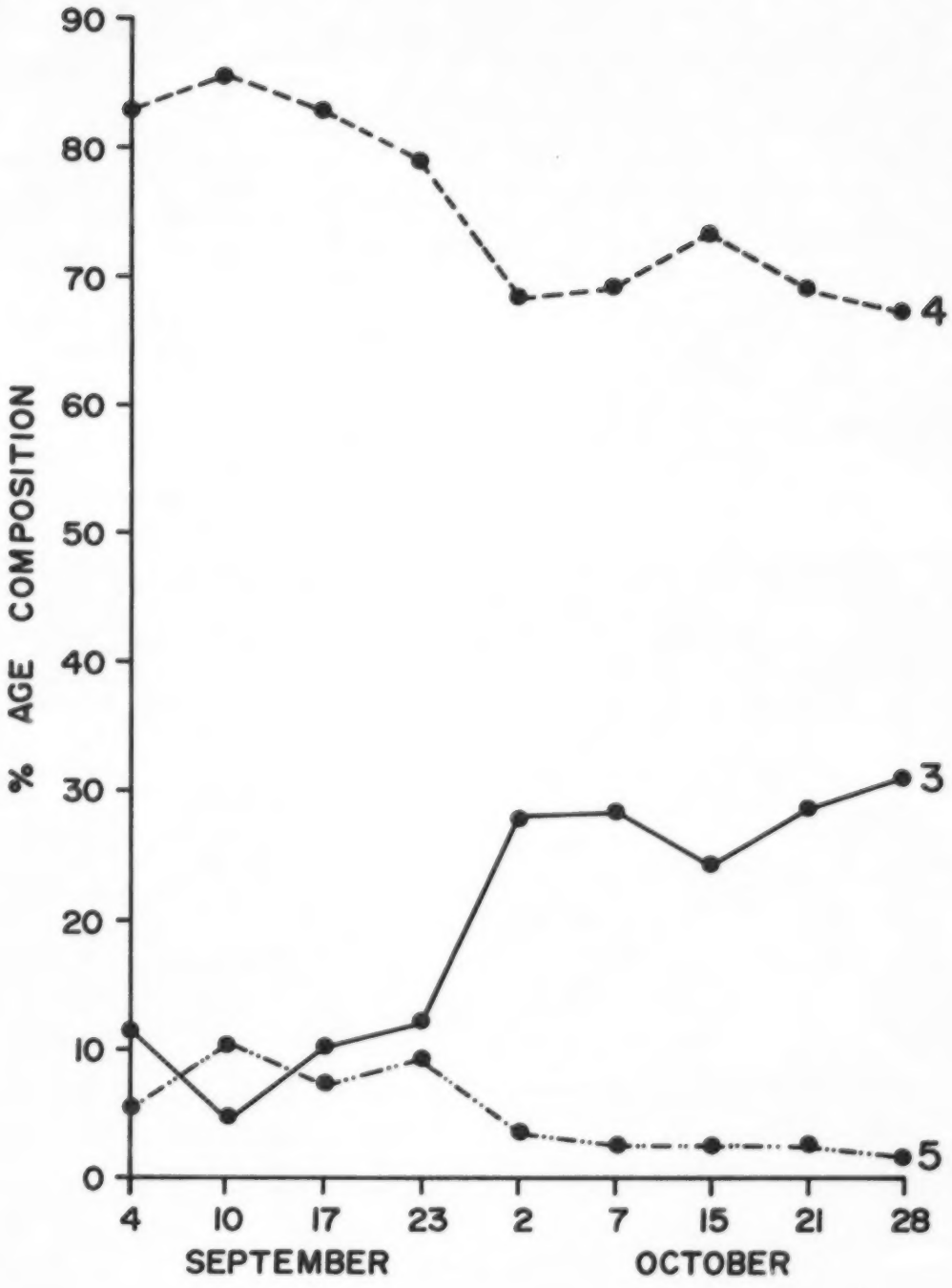


Fig. 4. Percentage age composition of chum salmon in the upper Johnstone Strait test fishery during 1982.

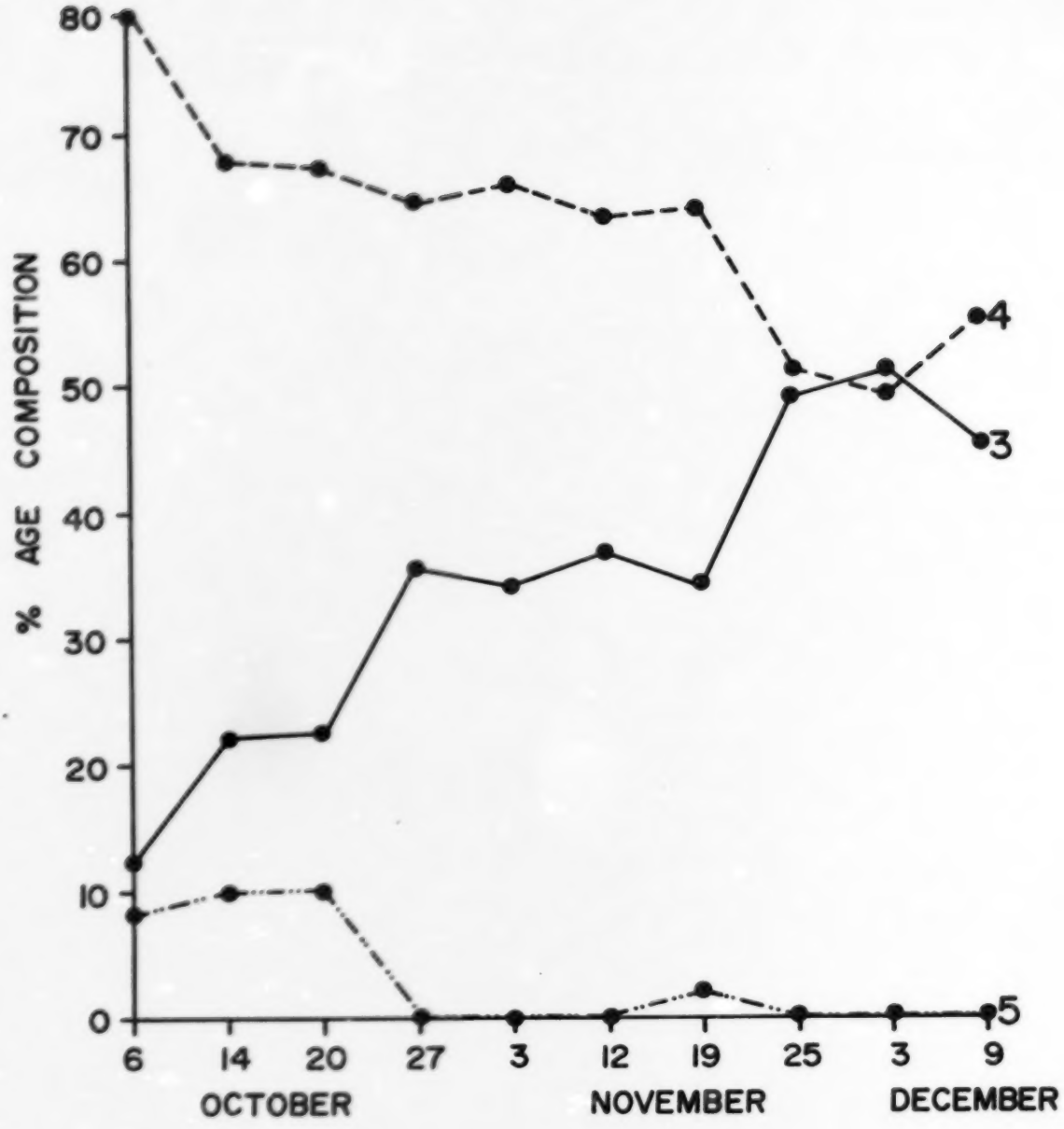


Fig. 5. Percentage age composition of chum salmon in the Fraser River test fishery during 1982.